

REMARKS/ARGUMENTS

Claims 1, 5-8, 12-14 and 19-26 are pending in the instant application.

Amendments to the Claims

As amended above, claims 19 and 21 are amended to strike yttrium oxide from the Markush group of claimed stabilizers. Additionally, new claims 23 and 25, dependent from claims 20 and 22, respectively, further recite the stabilizer content of claims 20 and 22 is between about 3-15 mol%. New claims 24 and 26, also dependent from claims 20 and 22, respectively, further recite the Markush group of oxides being limited to erbium oxide, yttrium oxide and praseodymium oxide. These new claims are fully supported by the original application as filed, for example in the originally filed claims. No new matter has been added.

Rejection Under 35 U.S.C. § 102

Claim 19 is rejected under 35 U.S.C. §102(a) and (e) as anticipated by U.S. Patent Application Publication 2002/0172838 by Rigney, et al. ("Rigney"). Applicant respectfully traverses the rejection, for at least the following reasons.

Claim 19 recites

A thermal barrier coating system comprising ... a ceramic thermal barrier layer [having] a columnar structure of a stabilized zirconia containing a stabilizer, and the stabilizer contained in the ceramic thermal barrier layer is at least one kind of an oxide selected from the group consisting of erbium oxide, gadolinium oxide, yttrium oxide, neodymium oxide, praseodymium oxide, cerium oxide and scandium oxide.

In contrast to claim 19, Rigney only discloses lanthanum oxide in addition to yttria (yttrium oxide). Rigney does not disclose any stabilizers of the amended Markush group in combination with lanthanum oxide, also recited in claim 19. "A prior art reference anticipates a claim only if the reference discloses, either expressly or inherently, every limitation of the claim." *Rowe v. Dror*, 112 F. 3d 473, 42 USPQ2d 1550 (Fed. Cir. 1997). Therefore, Applicant respectfully submits that claim 19 is patentable over Rigney, and kindly requests favorable reconsideration and withdrawal of the rejection.

Rejections Under 35 U.S.C. § 103

Claims 1, 5-7 and 20 are rejected under 35 U.S.C. §103(a) as obvious over Rigney taken alone. Applicant respectfully traverses the rejection, for at least the following reasons.

Claim 1 recites

A thermal barrier coating system comprising ... a ceramic thermal barrier

...

... contains 0.1 to 10 mol % of lanthanum oxide, and has a columnar structure of a stabilized zirconia containing a stabilizer, and the ceramic thermal barrier layer has a composition represented by the general formula:

$(Zr_{\alpha})O_{2-\beta}$ mol% (M_2O_3) - γ mol % (La_2O_3) (wherein M_2O_3 is the stabilizer and M consists of at least one element selected from Y, Er, Gd, Yb, Ce, Nd, Pr and Sc, and α , β and γ are coefficients) and the coefficients α , β and γ satisfy the relationships: $\alpha=1$, $3.1 \leq \beta \leq 15$, and $0.1 \leq \gamma \leq 10$.

The Office Action alleges that Rigney discloses 3 wt% yttria as preferable, and further discloses “conventionally 6-8 wt% [yttria] is used for thermal barrier coatings.” (Office Action at 4) From these statements, the Office Action draws the conclusion that “it would have been obvious to a person having ordinary skill in the art to use the conventional higher wt% of yttria such as about 6-8 wt% (about 3.5-5.25 mol%) to produce a thermal barrier coating with reduced thermal conductivity.” *Id.* Applicant respectfully disagrees.

Rigney discloses that conventional yttria-stabilized zirconium (YSZ) contains between 6-8 wt% yttrium. (e.g., para. [0008]) As part of Rigney’s departure from the conventional composition, it discloses that 1-3% yttria range is preferred along with one or more of the additional oxides. (para. [0021]) However, Rigney goes on to explicitly state that “the present invention makes use of very specific and limited amounts of these oxides in combination with only up to three weight percent yttria.” (para. [0022]) (emphasis added) Therefore, despite the fact that the conventional prior art teaches 6-8 wt% yttria in an YSZ composition, Rigney specifically teaches away from exceeding 3 wt% yttria in combination with the additional oxides. Therefore, Rigney actively teaches away from the modification proposed by the Office Action.

Moreover, the literature of the relevant art clearly evidences that the distinction between 1-3 wt% and 6-8 wt% yttria is not merely academic. In the article Phase Stability in Plasma-Sprayed, Partially Stabilized Zirconia-Yttria, Miller, *et al.*, made of record in an IDS filed

concurrently herewith, the phase diagram (Fig. 2, p. 252) shows that conventional 6-8 wt% YSZ, which equates to 3.4-4.5 mol%, places the composition in a region of the phase chart which indicate the form of the composition is a stable tetragonal phase. In contrast, Rigney discloses between 1-3 wt% yttria, which exists in the monoclinic phase, supplemented with lanthana. The volume of monoclinic YSZ is as much as 4% greater than an equal mass of tetragonal YSZ.

These difference between conventional or tetragonal YSZ (i.e., 6-8 wt%) given as background in Rigney, as contrasted with the monoclinic structure that is Rigney's disclosed invention (up to 3 wt%) would further reinforce to one of ordinary skill in the art Rigney's teaching away from exceeding 3 wt% yttria in combination with lanthana. Therefore, the claimed invention is unobvious over Rigney alone because both Rigney and the knowledge of one skilled in the art would teach away from the modification proposed in the Office Action.

Claims 5-7 each depend, either directly or indirectly, from independent claim 1. These dependent claims are each separately patentable, but are offered as patentable for at least the same reasons as their underlying independent base claim, which is incorporated by reference. Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Independent claim 20 recites

A thermal barrier coating system comprising ... a ceramic thermal barrier layer ...

...

the ceramic thermal barrier layer is composed of a plurality of columnar grains grown vertically from the surface of the metal substrate and having an orientation in the direction of the <100> or <001> plane, laminar or bar-shaped subgrains being arranged on the surface of the columnar grains, and nano-size pores being formed in each columnar grain, and wherein the ceramic thermal barrier layer has a porosity of 10 to 50% by volume.

The Office Action admits that Rigney "does not expressly disclose [columnar grains] explicitly in the <100> or <001> [planes], or laminar or bar-shaped subgrains in plane on the surface of the columnar grains, or the pore size or volume. However, a chemical compound and its properties are inseparable." (Office Action at 5). The Office Action goes on to allege that the claimed properties are inherently present in the prior art. Applicant respectfully disagrees.

It has been held by the courts that "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior

art.” *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). See also, *Akamai Technologies, Inc. v. Cable & Wireless Internet Services, Inc.*, 344 F.3d 1186, 68 USPQ2d 1186 (Fed. Cir. 2003) (“A claim limitation is inherent in the prior art if it is necessarily present in the prior art, not merely probably or possibly present.”)

The described features of claim 20 are not merely physical properties of the compound, but are characteristics of the specific claimed configuration, characteristics that are neither taught nor suggested in Rigney. To use an analogy, the Office Action’s argument would equate a sheet of ice with a container of ice cubes, simply because both have the chemical composition H₂O. However, the configuration of the former can provide a smooth surface for nearly frictionless motion, while the latter can provide increased surface area for greater heat transfer. Therefore, it is the configuration of the composition, not merely its chemical makeup, that are at issue. In this case, claim 20 recites a configuration of the grain, subgrain and porosity, which cannot be merely attributed to physical properties of the compound. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Additionally, new claim 23 depends from claim 20, and further recites that the content of the stabilizer is between about 3-15 mol%, in excess of the yttria stabilizer content combined with lanthana as disclosed in Rigney. New dependent claim 24 recites the stabilizer is at least one kind of an oxide selected from the group consisting of erbium oxide, ytterbium oxide and praseodymium oxide. These oxides are among those expressly excluded according to Rigney (para. [0009]). Therefore, dependent claims 23-24 are further distinguished over Rigney, and are patentable.

Claims 8, 12-14 and 21-22 are rejected under 35 U.S.C. §103(a) as obvious over Rigney in view of U.S Patent No. 4,939,107 to Ketcham (“Ketcham”). Applicant respectfully traverses the rejection, for at least the following reasons.

Claim 8 recites

A thermal barrier coating system comprising ... a ceramic thermal barrier layer ... wherein the ceramic thermal barrier layer contains 0.1 to 10 mol % of lanthanum oxide, and has a columnar structure of stabilized zirconia-hafnia solid solution containing a stabilizer...

The Office Action proposes a combination of Rigney with Ketcham to incorporate Ketcham’s teaching of a zirconia-hafnia solid solution. However, the addition of Ketcham’s zirconia-hafnia solid solution offers no teaching or suggestion to ameliorate the underlying deficiency of Rigney

with respect to claim 8, which is that there is no teaching or suggestion of 0.1 to 10 mol% lanthana together with between 3.1 and 15 mol% rare earth oxide stabilizer, for the reasons set forth above with respect to claim 1. Therefore, even if there were some objective reason to combine the references as proposed in the Office Action, their combination does not teach or suggest the claimed composition. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) (To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.)

Claims 12-14 each depend, either directly or indirectly, from independent claim 8. These dependent claims are each separately patentable, but are offered as patentable for at least the same reasons as their underlying independent base claim, which is incorporated by reference. Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Turning to claims 21 and 22, claim 21 has been amended above to strike yttrium oxide from the claimed Markush group. Rigney does not disclose the use of lanthanum oxide with any stabilizer other than yttrium oxide. Therefore, Rigney does not meet the terms of claim 21. Ketcham, on the other hand, and its teaching of a zirconia-hafnia solid solution, does not ameliorate this deficiency of Rigney. Therefore claim 21 is patentable over Rigney and Ketcham, taken singly or in combination.

Claim 22 recites, *inter alia*,

the ceramic thermal barrier layer contains 0.1 to 10 mol% of lanthanum oxide and has a columnar structure of stabilized zirconia-hafnia solid solution containing a stabilizer, and is composed of a plurality of columnar grains extending vertically from the surface of the metal substrate and having an orientation in the direction of at least one of the $\langle 100 \rangle$ and $\langle 001 \rangle$ plane, laminar or bar-shaped subgrains being arranged on the surface of the columnar grains, and nano-size pores being formed in each columnar grain, and wherein the ceramic thermal barrier layer has a porosity of 10 to 50% by volume.

The Office Action again asserts that these features are inherent in from Rigney and Ketcham, because of the alleged identity of chemical makeup. Applicant refers to the foregoing arguments in support of the same language of claim 20, and kindly requests favorable reconsideration and withdrawal of the rejection.

Additionally, new claims 25-26 are presented above, dependent from claim 22. These new claims are commensurate in scope with claims 23-24, discussed above, and are offered to

further distinguish over the proposed combination of Rigney and Ketcham. Indication of allowability is kindly requested.

Claims 1, 5-7 and 19-20 are rejected under 35 U.S.C. §103(a) as obvious over U.S. Patent Application Publication 2003/0059633-A1 to Ackerman, *et al.* ("Ackerman") in view of Rigney. Applicant respectfully traverses the rejection, for at least the following reasons.

The Office Action relies upon Ackerman as a base reference for its teaching of a superalloy component of a gas turbine system, i.e., turbine blade, nozzle vane, or combustor part, having a thermal barrier coating system. However, the Office Action acknowledges the Ackerman does not teach the recited composition including lanthana and stabilizer in the claimed proportions. For this, the Office Action relies upon Rigney, which has been shown above to actively teach away from the claimed composition. Moreover, as to claim 20, the Office Action again relies upon the assertion that "a chemical composition and its properties are inseparable," without regard to the fact that it is the configuration of the material, not merely its physical properties, that are recited in claim 20.

Therefore, because the rejection relies upon the application of Rigney which has been obviated above, Applicant respectfully submits that, even presuming that there is some objective reason for one of ordinary skill in the art to combine Ackerman and Rigney as proposed, their combination does not teach or suggest all features of independent claims 1, 19 or 20. Claims 5-7 each depend, either directly or indirectly, from independent claim 1. These dependent claims are each separately patentable, but are offered as patentable for at least the same reasons as their underlying independent base claim, which is incorporated by reference. Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Claims 8, 12-14 and 19-22 are rejected under 35 U.S.C. §103(a) as obvious over Ackerman in view of Rigney, and further in view of Ketcham. Applicant respectfully traverses the rejection, for at least the following reasons.

Like the foregoing rejection based upon Ackerman and Rigney alone, this rejection substitutes Ackerman and Rigney in place of Rigney, and proposed a further combination with Ketcham, as recited above. However, as was the case with Ackerman and Rigney as applied to claims 1, 19 and 20, the addition of Ackerman does not ameliorate the deficiencies of Rigney and Ketcham with respect to the features of independent claims 8 and 19-22. Moreover, the office Action does not assert that the combination of Ackerman, Movchan and Ketcham suggests

more than the sum of their parts. Therefore, Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Claims 1, 5-7 and 19 are rejected under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,790,486-B2 to Movchan, *et al.*, (“Movchan”) taken alone. Applicant respectfully traverses the rejection, for at least the following reasons.

As to the claimed composition of a ceramic thermal barrier layer including 0.1 to 10 mol% lanthanum oxide, the Office Action acknowledges that Movchan teaches only ceria at 10-20 wt% in combination with yttria between 3-8 wt%. The Office Action asserts that ceria and lanthana are functional equivalents, citing Movchan, Col. 5, lines 35-40. However, the knowledge of one skilled in the art would not equate the two oxides. Filed concurrently herewith in an IDS is the article Effect of Dopants on Zirconia Stabilization – An X-ray Absorption Study: II. Tetravalent Dopants, Li, *et al.* (“Li”). Li discloses that yttrium, 3+ valence, produces oxygen vacancies which stabilize the matrix. (I. Introduction) On the other hand, ceria, 4+ valence, the same as zirconia, also 4+ valence, does not create anion vacancies. *Id.* Therefore, the mechanism of stabilization between ceria and lanthana is different, and one of ordinary skill in the art would not cavalierly substitute one for the other in identical amounts and expect identical effects. One of ordinary skill in the art would be led away from the proposed substitution because of the differing chemical stabilization mechanisms.

Therefore, Applicant respectfully submits that independent claims 1 and 19 are patentable over Movchan. Claims 5-7 each depend, either directly or indirectly, from independent claim 1. These dependent claims are each separately patentable, but are offered as patentable for at least the same reasons as their underlying independent base claim, which is incorporated by reference. Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Claim 20 is rejected under 35 U.S.C. §103(a) as obvious over Movchan in view of Rigney. Applicant respectfully traverses the rejection, for at least the following reasons.

The Office Action relies upon Movchan together with the proposed substitution of lanthana for ceria, which has been obviated above. Further, the Office Action proposes a combination with Rigney to achieve the configuration features of claim 20, in the same manner as Rigney alone is applied to claim 20, also obviated above. Neither reference taken alone teaches the features of claim 20. The Office Action does not assert that the combination of reference suggest more than either alone, but picks and chooses among the features of each to

assemble a combination asserted to meet the claims. However, as already shown, this is not supported by the references. Therefore, because all features of claim 20 are not taught or suggested, Applicant respectfully submits that claim 20 is patentable over Movchan or Rigney, taken singly or in combination. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Claims 8, 12-14 and 21 are rejected under 35 U.S.C. §103(a) as obvious over Movchan in view of Ketcham. Applicant respectfully traverses the rejection, for at least the following reasons.

As already stated, Movchan does not suggest to one of ordinary skill in the art the substitution of lanthana for ceria as proposed in the Office Action. The addition of Ketcham for its teaching of a zirconia-hafnia solid solution does not ameliorate this deficiency of Movchan relative to independent claims 8 and 21, which both recite, *inter alia*, that the ceramic thermal barrier layer contains 0.1 to 10 mol % of lanthanum oxide. Therefore, Applicant respectfully submits that independent claims 8 and 21 are patentable over Movchan and Ketcham, taken singly or in any combination. Claims 12-14 each depend, either directly or indirectly, from independent claim 8. These dependent claims are each separately patentable, but are offered as patentable for at least the same reasons as their underlying independent base claim, which is incorporated by reference. Applicant kindly requests favorable reconsideration and withdrawal of the rejection.

Claim 22 is rejected under 35 U.S.C. §103(a) as obvious over Movchan in view of Ketcham, and further in view of Rigney. Applicant respectfully traverses the rejection, for at least the following reasons.

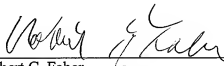
Rigney is added to the rejection of claim 22 for the proposition the “a chemical composition and its properties are inseparable.” However, this aspect of Rigney has already been addressed above, in that the features of claim 22 are not merely defined by the chemical composition, but the configuration of the thermal barrier coating. Moreover, the Office Action does not assert that the combination of Movchan, Ketcham and Rigney suggests any more than their constituent parts, which have already been shown not to meet claim 22. Therefore, even presuming some objective reason to combine the references as proposed in the Office Action, their combination does not teach all features of claim 22. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Conclusion

In light of the foregoing, Applicant respectfully submits that all claims are patentable, and kindly solicits and early and favorable notice of allowance.

THIS CORRESPONDENCE IS BEING SUBMITTED
ELECTRONICALLY THROUGH THE UNITED STATES
PATENT AND TRADEMARK OFFICE
EFS FILING SYSTEM
ON JUNE 1, 2007

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